

ELECTRICAL GENERAL PROVISIONS

1.00 GENERAL REFERENCE

A. The General Conditions, Supplementary General Conditions, Owner's Required Supplemental General Conditions and Division 1 of these Specifications are hereby included as part of this Section.

1.01 DESCRIPTION

A. The electrical work includes the following:

1. Demolition
2. Installation of temporary power and lighting
3. Underground site utilities
4. Secondary power distribution system
5. Lighting system
6. Emergency lighting system
7. Video system
8. Voice system
9. Data System
10. Fire alarm system
11. Door access and monitoring system (Raceway Only)
12. Grounding system
13. Testing

B. Provide all conduit, conduit fittings, outlet switch and junctionboxes and fittings; conduit hangers, clamps and supports; pull boxes, splice boxes, wires and cables; insulating materials; wire connectors and receptacles; disconnecting switches and fuses; circuit breakers, pilot devices; identification nameplates; tags; panelboards; and all other equipment and accessories necessary, implied or specified herein or indicated on the Drawings or schedules, including all necessary anchors, sleeves, hangers, and such other items as may be required for attaching or connecting this work to the work of others.

C. Work to be performed, furnished, installed, located, set or connected by others as listed or described herein or in other sections of these specifications shall be coordinated with the electrical contractor.

D. The Contractor shall familiarize himself with the existing facilities and difficulties by visiting the job site and shall be responsible for the execution of all the work related to these specifications. No claims will be allowed resulting from any discrepancies.

1.02 RELATED WORK DESCRIBED ELSEWHERE:

A. The Responsibility for electrical work and item in connection with electrically operated equipment furnished by others or under other division of these specifications is as follows:

1. Heating, ventilating and air conditioning (HVAC) system will be accomplished under Mechanical work.

B. Existing conditions are shown as accurately as could be determined by field investigating and examination of existing documents. Actual conditions shall be determined in the field by the contractor.

1.03 MATERIAL AND WORKMANSHIP:

A. All materials shall be new and shall conform with the standard of the Underwriters' Laboratories, Inc. in every case where such a standard, listing or label has been established for the particular type of material in question.

B. Laws and regulation. The installation, including temporary power and lighting for construction, shall comply with all State and local laws and regulations applying to electrical installations, with all applicable requirements of the latest edition of the National Electrical Code.

C. The electrical contractor shall obtain all permits, pay all fees and give all proper Authorities all requisite notices.

D. Names of manufacturers, catalog numbers, models or types, when used in this section of the specifications and the included drawings, are intended to indicate the standards of type and quality of material, when apparatus or equipment is mentioned, any first class product made by a reputable manufacturer may be used providing it conforms to the requirements of the these specifications and meets with the approval of the Architect/Engineer. Where two or more units of the same class of equipment are required these units shall be the products of a single manufacturer. Should this Contractor desire to substitute other makes of material, apparatus or equipment for specific items mentioned herein or indicated on the Drawings, he shall make the request in one of the following ways and with the following provisions:

E. By a separate alternate proposal, based on providing the proposed substitute. Such proposal shall be accompanied by complete drawings and specifications of the substitute, including manufacturer, brand name, catalog number and such other data. Where such substitutes alter the design or scope requirements, the Contractor shall include all item of cost for the revised design and construction including cost of all trades involved. Refer to Basic Materials and Methods.

F. By making a request to the Architect/Engineer within 30 days after the award of the Contract to be allowed to make the substitution. This request shall be accompanied by complete drawings and specifications of the substitute offered.

G. Acceptance or rejection of the proposed substitutions shall be subject to approval by the Architect/Engineer.

H. The substitute offered shall not involve a change in the basic design of the specified

I. The Contractor shall submit samples of both the specified item and the substitute when so requested by the Architect/Engineer.

J. In the event that substitutes are accepted, the net cost plus installation cost of those items specified, the Contract price shall be reduced by an amount equal to the difference in the above costs between them.

K. If the item offered for substitution are, in the opinion of the Architect/Engineer equal to or better than those specified, or the price differential is such that the substitute item is a better investment, then the substitute will be given consideration.

1.04 DRAWINGS:

A. The drawings show the layout of the electrical system and indicate the approximate locations of outlets, apparatus and equipment. The runs of feeders and branches as indicated are schematic only. The exact routing of conduit shall be determined by the Structural conditions and other obstructions. This shall not be construed to mean that the design of the systems may be changed but refers only to exact runs of conduit between given points.

B. Consult all contract drawings, which may affect the location of any outlets, apparatus and equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in location of outlets, apparatus and equipment up to the time of rough-in is reserved by the Architect/Engineer and such change shall be made without additional expense to the Owner.

C. It shall be the responsibility of this Contractor to see that all electrical equipment such as junction and pull boxes, panelboards, switches, controls and such other apparatus as may require maintenance and operation from time to time is made easily accessible. Although the equipment may be shown on the Drawings in certain locations, the construction may disclose the fact that such location do not make its position readily accessible. In such cases, this contractor shall call the attention of the Architect/Engineer to the condition before advancing the construction to a state where a change will reflect additional expenses.

D. Record drawings:

1. Maintain at the job site at all times a complete set of blue-line prints of the electrical work on which shall be marked, clearly, neatly, accurately and promptly as the work progresses.

1.05 SHOP DRAWINGS AND SAMPLES:

A. Before ordering material shipped to the job, submit shop drawings for approval giving all dimensions and details. Each drawing shall all be marked for this project.

B. Drawings and samples shall be provided in accordance with Basic Materials and Methods.

C. Electrical contractor shall also furnish samples of disconnect switches and other small parts as requested.

D. General bulletins of catalogs will not be accepted as shop drawings unless the equipment on which approval is to be obtained is specifically marked and all information pertaining to the item, including dimensions where required for installation, is included.

E. In case of any of the above materials are delivered or installed on the job for which shop drawings or requested samples have not been approved and/or which are not in accordance with the specification, the Contractor will be required to remove such materials and substitute approved materials at his own expense and as directed.

F. Manufacturers notarized certificates of compliance shall be provided for all cable.

1.06 GUARANTEE:

A. The Contractor shall guarantee all systems, including fixtures, to be free from short circuits, open circuits, loose connections over-heating and such other defects.

1.07 EQUIPMENT AND SCAFFOLDING:

A. The Contractor performing work under this section shall be responsible for furnishing all tools and equipment, scaffolding and other temporary construction required for the execution of the work.

1.08 TEMPORARY POWER AND LIGHT:

A. The Electrical Contractor shall provide a temporary electrical service for the power and lighting requirements during construction.

B. Each trade shall provide and maintain, at its own expense, all temporary wiring, extension cords, lighting, appliances and accessories for lights or power tools required in addition to and beyond the outlets mentioned above for their own respective work requirements for temporary power and for temporary lighting.

C. The cost of electrical energy used for temporary power and lighting for the work of all trades shall be borne by the General Contractor.

D. Upon completion of the work of all trades and before final acceptance of the entire project, each trade shall remove, at his own expense all wiring appliances and accessories used in the performance of its respective work to the complete satisfaction of the Architect/Engineer.

1.09 INSPECTION AND TESTS:

A. All connections at cabinets, switches, circuit breakers and all splices must be made at the time of final inspection and testing. All circuits shall be continuous from service switches to each outlet. Each system shall test free from short circuits and ground and shall have an insulation resistance between conductors and ground based on maximum load not less than requirements of the latest edition of the National Electrical Code.

B. Voltages shall be tested at the line side of the main secondary breaker with all switches or circuit breakers in the open position.

C. All circuit breakers shall be tested for instantaneous and time delay trip. Breakers shall be tested at 300 percent overload. Certification by the manufacturer that the equipment furnished will conform to the above requirements will be acceptable.

D. The grounding installation shall be tested and the resistance between ground and absolute earth shall not exceed 7 ohms and shall be measured by this Contractor before equipment is placed in operation.

E. All testing equipment necessary to satisfactorily conduct the tests mentioned above shall be provided. The test shall be made under the direction of the Architect/Engineer at no additional expense to the Owner.

F. Failure of defects in workmanship or materials revealed by test or inspection shall be corrected promptly and test shall be repeated. Defective material shall be replaced promptly at no additional expense to the Owner. The results of all test conducted shall be forwarded in writing to the Architect/Engineer, insofar as practical a normal full load test shall be made on the power and lighting systems.

G. If the voltage and regulation of the existing system are not within acceptable limits, arrange with the serving utility for proper voltage.

H. Measure minimum and maximum voltages, measure voltage between phase wires and neutral.

I. Copies of all test reports shall be submitted to the Architect/Engineer in writing.

1.10 CUTTING AND PATCHING:

A. All cutting shall be done as specified in Section 01050 of these specifications.

1.11 TYPES OF SERVICE:

A. Secondary distribution system shall be 208Y/120 Volt three phase, 4 wire.

1.12 COORDINATION:

A. The Contractor shall be responsible for fully coordinating all of the various parts of the work included under this Section, and such other work of this Contract as it may affect the work of this Section, throughout the various phases of construction and before the ordering or fabrication of the various parts of the work, so as to ensure compliance with the drawings and specifications, and as necessary to provide the installations complete and in satisfactory operating condition.

END OF SECTION

BASIC MATERIALS AND METHODS

1.00 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
ANSI C80.1, Rigid Steel Conduit - Zinc Coated
ANSI C80.3 Electrical Metallic Tubing - Zinc Coated

AMERICA SOCIETY FOR TESTING AND MATERIALS (ASTM)
ASTM B1 Hard-Drawn Copper Wire
ASTM B8 Concrete-Lay-Stranded Copper Conductor Softs, Hard, Medium-Hard, or Soft
ASTM E814 Fire Test of Through-Penetration Fire Stops

FEDERAL SPECIFICATIONS (FS)
FS L-P-387 Plastic sheath, Laminated Thermosetting (For Design Plates)
FS W-5-895 Switches, Toggle (Toggle and Lock), Flush Mounted

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
NEMA ICS 1 Industrial Control and Systems
NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies
NEMA ICS 4 Terminal Blocks for Industrial Use
NEMA ICS 6 Enclosure for Industrial Control and Systems
NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA TC 3 1990 PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WD 1 1983/R 1989 Wiring Devices
NEMA WD 6 1988 Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70 National Electrical Code

UNDERWRITERS LABORATORIES INC. (UL)
UL 1 Flexible Metal Conduit
UL 5 Surface Metal Raceways and Fittings
UL 6 Rigid Metal Conduit
UL 44 Rubber-Insulated Wires and Cables
UL 50 Safety Enclosures for Electrical Equipment
UL 83 Thermoplastic-Insulated wires and Cables
UL 360 Liquid-Tight Flexible Steel Conduit
UL 467 Grounding and Bonding Equipment
UL 486A Wire Connectors and Soldering Lugs for Use With Copper Conductors
UL 486C Splicing Wire Connectors
UL 489 Attachment Plugs and Receptacles
UL 508 Industrial Control Equipment
UL 510 Insulating Taps
UL 514A Metallic Outlet Boxes
UL 514B Fittings for Conduit and Outlet Boxes
UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 651 Schedule 40 and 80 Rigid PVC Conduit
UL 797 Electrical Metallic Tubing
UL 1242 Intermediate Metal Conduit
UL 1569 Metal-Clad Cables

1.01 SUBMITTALS

A. Submit the following in accordance with Section 16100, "Shop Drawings".

1. Manufacturer's Catalog Data

a) Receptacles
b) Circuit breakers
c) Switches
d) Conduit and fittings (each type)
e) Surface metal raceway
f) Ground rods
g) Device plates
h) Wires and cables
i) Outlet boxes and covers
j) Junction boxes
k) Splices and termination components
l) Enclosed circuit breakers
m) Firestopping materials

2. Drawings

a) Panelboards
b) Cable trays
c) Wireways
3. Field Test Reports
a) 600-volt wiring test
b) Grounding system test
c) GFCI receptacle test
d) Firestopping field test

4. Operation and Maintenance Manuals

a) Electrical Systems

a) Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:
(1) Single line diagram of the "as-built" building electrical system.
(2) Schematic diagram of electrical control system (other than HVAC, covered elsewhere).
(3) Manufacturers' operating and maintenance manuals on active electrical equipment.

1.02 QUALITY ASSURANCE

A. In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears.

Part 2 PRODUCTS

2.00 MATERIALS AND EQUIPMENT

A. Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.01 CONDUIT AND FITTINGS

A. shall be rigid steel (zinc-coated) conduit, rigid nonmetallic conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT), and flexible metal conduit, liquid tight flexible conduit, conforming to the following:

1. Rigid Steel Conduit (Zinc Coated)
ANSI C80.1, UL 6
2. Rigid Nonmetallic Conduit
PVC Type EOC-40, and EPC-80 in accordance with NEMA TC 2, or fiberglass conduit, in accordance with NEMA TC 14.
3. Intermediate Metal Conduit (IMC)
UL 1242, zinc-coated steel only
4. Electrical Metallic Tubing (EMT)
UL 797, ANSI C80.3
5. Flexible Metal Conduit
UL 1
a) Liquid-Tight Flexible Metal Conduit, Steel UL 360.
6. Fittings for Metal Conduit, EMT, and Flexible Metal Conduit
UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.
a) Fittings for Rigid Metal Conduit and IMC Threaded-type. Split couplings are unacceptable.
b) Fittings for EMT Steel set-screw type. Die cast fittings are unacceptable.
7. Fittings for Rigid Nonmetallic Conduit
NEMA TC 3. UL 514B, UL 651.

2.02 OUTLET BOXES AND COVERS

A. UL 514A, cadmium- or zinc-coated, if ferrous metal, UL 514C if nonmetallic.

2.03 CABINETS, JUNCTION BOXES, AND PULL BOXES

A. Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.04 WIRES AND CABLES

A. Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

1. Conductors
Conductors No. 10 AWG and larger diameter shall be stranded. Conductors No. 12 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.
a) Minimum Conductor Sizes
Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2. Color Coding
Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals, except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

3. Insulation
Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, type THWN/THHN; remote-control and signal circuits shall be Type TW, THW, of TF. Conductors shall conform to UL 83. Where lighting fixtures require 90 degrees C conductors, provide only conductors with 90 degree C insulation or better.

4. Bonding Conductors
ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

5. Metal-Clad Cable
UL 1569, NFPA 70, Type MC cable.

2.05 SPLICES AND TERMINATION COMPONENTS

A. UL 486A and UL 486B, as applicable, for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.06 DEVICE PLATES

A. Provide UL listed, one-piece device plates for outlets to suit the device installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished wall shall be satin finish stainless steel or brushed-finish aluminum, minimum 0.03-inch thick. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations." Finish Plates shall be type 430 stainless steel. Part Numbers shall be SS style manufactured by Hubbell Wiring Devices or approved equivalent.

2.07 SWITCHES

A. Toggle Switches
FS W-S-896, totally enclosed with bodies of thermosetting plastic and mounting strap. Handles shall be ivory. Wiring terminals shall be screw-type, side-wired. Switches shall be rated quite-type ac only, 120/277 volts, with current rating and number of poles indicated. Switches shall be Hubbell Pro Series catalog number 12211,12221,12231,12241 manufactured by Hubbell Wiring Devices or Approved Equivalent.

1. Pilot Lights
Provide yoke-mounted, candelabra-base sockets rated 125 volts and fitted with glass or plastic jewels. Provide clear, 6-watt lamp in each pilot switch. Jewels for use with switches controlling motors shall be green; jewels for other purposes shall be white.

2. Breakers Used as Switches
For 120 volt fluorescent fixtures, mark breakers "SWD" in accordance with UL 489.

2.08 RECEPTACLES

A. UL 498 and NEMA WD 1, heavy-duty, grounding type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Wiring terminals shall be screw-type, side-wired. Connect grounding pole to mounting strap.

1. General purpose receptacles, unless otherwise noted, shall be of the flush, duplex type, commercial specification grade. General purpose receptacles shall be of the flush, duplex 3 wire grounding type. Receptacles shall have a rating of 15 amperes at 125 volts and shall have fire-resistant non-absorptive hot-molded composition bodies and metal plaster ears integral with the supporting members. Receptacles shall be arranged for either back or side wiring and equipped with U-shaped slots for ground blade and shall also be suitable for use with standard 2 wire regular or polarized caps in the conventional way. Receptacles shall conform to OSHA requirements. Receptacles shall be Hubbell Pro Series, catalog number 52621. Manufactured by Hubbell Wiring Devices or approved equivalent.

B. Receptacles located in areas where power floor waxes area used shall be duplex type rated 20 amperes at 125 volts. Receptacles shall be Hubbell Pro Series catalog number 5362. Manufactured by Hubbell Wiring Devices or approved equivalent.

C. Isolated ground receptacles, denoted with subscript (IG) on the drawings shall be transient voltage surge suppressor (TVSS) duplex type rated 20 amperes at 125 volts, Surge receptacles shall be Hubbell IG5362SA. Manufactured by Hubbell Wiring Devices or approved equivalent.

D. UL 943, Ground fault circuit interrupter receptacles, denoted with subscript (GFI) on the drawings shall be duplex type rated 20 amperes at 125 volts, for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFCI devices. GFCI receptacles shall be Hubbell GF20LA type. Manufactured by Hubbell Wiring Devices or approved equivalent.

E. Exterior ground fault circuit interrupter receptacles, denoted with subscript (WP, GFI) on the drawings shall be duplex type rated 20 amperes at 125 volts. Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed spring hinges and cast cover cap requirements of UL 943 for Class A GFCI devices. GFCI receptacles shall be Hubbell GF20LA type. Manufactured by Hubbell Wiring Devices or approved equivalent.

F. Tamper resistant receptacles, denoted with subscript (TP) on the drawings shall be duplex BR20TR type. Manufactured by Hubbell Wiring Devices or approved equivalent.

2.09 ENCLOSED CIRCUIT BREAKERS

A. UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Provide solid neutral. Enclosure type as indicated. Provide solid neutral.

2.10 MOTOR CIRCUIT PROTECTORS (MCP)

A. Motor circuit protectors, NEMA AB 1 and UL 489. MCPs shall consist of an adjustable instantaneous trip circuit breaker in conjunction with a combination motor controller which provides control for the motor and overload and short circuit protection. MCPs shall be rated in accordance with NFPA 70.

2.11 FUSES

A. NEMA FU 1. Provide complete set of fuses for each facility switch. Time-current characteristics curves of fuses serving motors of connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

1. Cartridge Fuses, Current Limiting Type (Class R)
UL 198E, Class Rk-5. Associated fuseholders shall be Class R only.
2. Cartridge Fuses, Current Limiting Type (Classes J, L, and CC)
UL 198C, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amps.
3. Cartridge Fuses, Current Limiting Type (Class T)
UL 199H, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.12 MANUAL MOTOR STARTERS

A. Provide number of poles required for the application, suitable for surface mounting with thermal overload protection and pilot lights.

2.13 ENCLOSED SWITCHES

A. Provide number of poles required for the application, suitable for surface mounting with Fuse clips designed to accommodate class R fuses. Provide general duty motor disconnect switches for up to 240 volts and 1.5 HP, heavy duty for over 240 volts or 1.5 hp, quick make/break type, fused or nonfused (NF) as indicated. For 1/2 HP or less, motor rated toggle switches are permitted.

2.14 DATA WIRING SYSTEM

A. Provide system of data wire-supporting structures, including: conduits, cables, cable trays, terminal boxes, outlet and junction boxes, other accessories for telecommunications and data outlets, cabinets, closets and backboards.

1. Outlet Boxes for Data System
Standard type, as specified herein, 4 inches by 4 inches with single gang adapter plate. Mount flush in finished walls at height specified for outlet receptacles. Outlet boxes for wall-mounted telephones shall be 2 inches by 4 inches by 1-1/2 inches deep; mounted at height 60 inches above finished floor. Outlet boxes for handicapped telephone station shall be 2 inches by 4 inches by 1-1/2 inches deep and mounted at height 48 inches above finished floor.

2. Conduit Sizing
Conduit for single outlets shall be minimum of 3/4 inch and for multiple outlets minimum of one inch. Size conduits for data risers to cabinets, junction boxes, distribution centers, and service, as indicated.

3. Backboards
Interior grade plywood, 3/4-inch thick, 4 by 8 feet minimum.

4. Receptacles for Telephone Service
Provide receptacles, 125 volts, 20 amps, single phase, 60 Hz, adjacent to telephone backboards, served from panelboard circuit as indicated.

2.15 GROUNDING AND BONDING EQUIPMENT

A. UL 467. Ground rods shall be of the sectional type copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.16 NAMEPLATES

A. FS L-P-387. Provide as indicated on drawings.

2.17 FIRESTOPPING MATERIALS

A. Provide asbestos free firestopping system where indicated capable of maintaining an effective barrier against flame and gases. System shall be UL listed and comply with ASTM E 814. Include UL system number with UL listed print from manufacturer for each type of floor, wall, and ceiling penetration.

2.18 WIREWAYS

A. UL 870. Materials shall be steel epoxy painted. 16 page for sizes 2 1/2 by 2, 4 by 4, 6 by 6 inches, 14 gauge for sizes 8 by 8, 12 by 12 inches. Provide in length required for the application with screw-on cover NEMA 1 enclosure per NEMA ICS 6.

PART 3 EXECUTION

3.00 INSTALLATION

A. Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

1. Underground Service
Underground service conductors and associated conduit shall be continuous from service entrance equipment to power system connection.

2. Service Entrance Identification
Service entrance disconnect devices, switches, or enclosures shall be labeled or identified as such:

a) Labels
Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic label conforming to paragraph entitled "Nameplates." Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3. Wiring Methods
Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Provide insulated, green equipment grounding conductor intertie and branch circuits, including lighting circuits. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated, green equipment grounding conductor for circuit installed in conduit or raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit or fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors for minimum distance of 6 inches.

a) Restrictions Applicable to EMT
(1) Do not install underground.
(2) Do not encase concrete, mortar, grout, or other cementitious materials.
(3) Do not use in area subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
(4) Do not use outdoors.
(5) Do not use in class I, Group B locations.
b) Restrictions applicable to PVC Schedule 40 and PVC Schedule 80
(1) Do not install above grade or within building interior unless indicated otherwise on the Drawings.
c) Restrictions Applicable to Flexible Conduit
Use only as specified in paragraph entitled "Flexible Connections."
d) Service Entrance Conduit, Underground
PVC, Type-EPC-40. Convert nonmetallic conduit, other than PVC Schedule 80, to rigid steel conduit or steel IMC before rising through floor slab.
e) Underground Conduit Other Than Service Entrance
PVC, Type-EPC-40. Convert nonmetallic conduit, other than PVC Schedule 80, to rigid steel conduit or steel IMC before through floor slab.
f) Conduit in Floor Slabs
Rigid steel; steel IMC, or PVC, Type EPC-40.
g) Metal Clad Cable
Install in accordance with NFPA 70, Type MC cable.

4. Conduit Installation
All conduit shall be installed concealed in new and existing construction. Where conduit cannot be installed concealed behind or within existing walls, ceilings or floors, surface run conduit shall be permitted with the written approval of the Architect on a case-by-case basis. Surface conduit installed without written Architectural approval shall be removed and installed concealed at the Contractor's expense, to the complete satisfaction of the Architect. Surface conduit, including junction boxes and fittings shall be field painted by the Contractor. Paint color shall match mounting surface color. Paint color samples shall be submitted for Architect approval prior to connecting work.

Conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project. Run conduits in under floor slab as if exposed.